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MINUTEMAN PERSONNEL SELECTION STUDY

William H. Hendrix, Captain, U.S.A.F.

March 1972

TECHNICAL REQUIREMENTS AND STANDARDS OFFICE
HQ ELECTRONIC SYSTEMS DIVISION (AFSC)
L. G. Hanscom Field, Bedford, Massachusetts 01730

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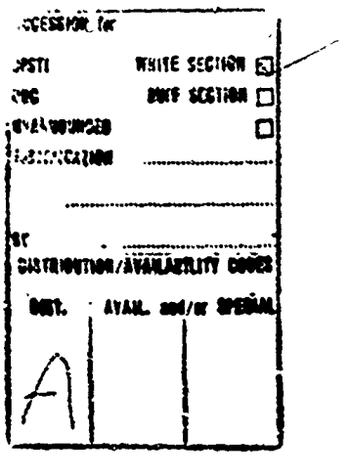

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13. ABSTRACT

This report is a pilot study which deals with the selection of personnel for assignment as Minuteman Missile Combat Crew Members. The data evaluated consists of biographical data, Officer Efficiency Reports, and Air Training Command Standard Scores obtained on individuals during individual missile training. Two predictors of performance were isolated using a multiple regression technique, which incorporated the use of dummy variables. The importance of this study, however, is not limited only to those variables found to be significant. In fact, an example cited in the study indicates that certain variables which are not predictive of success could have an equally important managerial implication. It is recommended that future research be undertaken to evaluate ORT scores, AFOQT scores, and other pre-service variables such as Grade Point Average as possible predictors. Isolation of additional predictor variables when combined with those isolated by this study could result in a flexible selection program for Minuteman Missile Combat Crew Members.

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FOREWORD

This Technical Report is based on a pilot study dealing with the feasibility of developing an improved personnel selection procedure for Minuteman Missile Combat Crew Members.

The author wishes to express his appreciation for the data supplied for this study by Headquarters Strategic Air Command (DPPRM and DOTMT) and the Air Training Command (TSDMG, Chanute AFB, Illinois). The author is also deeply indebted to Lt Col Thomas Graham, AFHRL (AFSC), USAF Academy, for his assistance in computer programming and his constructive criticism of the study; and Mrs. Mary Batson, Frank J. Seiler Research Laboratory (AFSC), USAF Academy, for her assistence in preparing the data for computer processing. This project was funded by the Air Force Human Resources Laboratory, and the Air Force Systems Command through the USAF Academy, Director of Faculty Research.

This Technical Report has been reviewed and is approved.

Carmine Pinto

CARMINE PINTO, Chief
Tech Rqmts & Stds Office

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This report is a pilot study which deals with the selection of personnel for assignment as Minuteman Missile Combat Crew Members. The data evaluated consists of biographical data, Officer Efficiency Reports, and Air Training Command Standard Scores obtained on individuals during individual missile training. Two predictors of performance were isolated using a multiple regression technique, which incorporated the use of dummy variables. The importance of this study, however, is not limited only to those variables found to be significant. In fact, an example cited in the study indicates that certain variables which are not predictive of success could have an equally important managerial implication. It is recommended that future research be undertaken to evaluate ORT scores, AFOQT scores, and other pre-service variables such as Grade Point Average as possible predictors. Isolation of additional predictor variables when combined with those isolated by this study could result in a flexible selection program for Minuteman Missile Combat Crew Members.

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SECTION I

INTRODUCTION

1. GENERAL. In January, 1969, USAF Headquarters Personnel (AFMPC) expressed interest to Headquarters SAC in improving the quality of missile force personnel. In an attempt to improve the quality of the missile force certain questions needed answers. The following are some of the critical questions addressed in the correspondence:

Is grade an important factor?

Is background (education and experience) important?

Is length of service related to performance?

Is source of commission a factor of importance?

Are there other important factors which have not been addressed?

At the time of this correspondence there was no method of selection established which would select those officers which had the highest probability of being successful Missile Combat Crew Members (MCCM's). This study was an outgrowth of Headquarters SAC's request for assistance in this area from the USAF Academy.

2. OBJECTIVES. This study was intended as a pilot study to establish the feasibility of a Minuteman Missile Combat Crew selection program. The objectives of the study were:

a. To establish a criterion of job success.

b. To identify variables which are characteristic of the successful Minuteman Missile Combat Crew Member, and their degree of importance.

c. To recommend a course of action for establishing a procedure for identifying the potentially successful Minuteman Missile Combat Crew Member from the total officer resource pool.

SECTION II

SCOPE AND PROCEDURE

1. GENERAL. The scope included:

a. Investigating officer personnel assigned as Minuteman Missile Combat Crew (MMCC) Members as of 1 July 1969.

b. A comprehensive review of the literature associated with the problem area in order to provide a sound base for further research.

c. A review of various indices of job success for possible use as a criterion of performance.

The procedure involved:

a. Establishing a criterion of job success (as a MMCC member).

b. Collecting data.

c. Analyzing data.

2. CRITERION. Establishing a criterion of job success was accomplished by drawing upon the experience of former Minuteman Missile Combat Crew Members, a review of the literature on criterion development, and by analysis of those indices available. The indices reviewed consisted of OER means, tenure, Missile Combat Crew Member Evaluation Indices (standboard scores), and rank-order ratings. All of the criteria considered were eliminated because of non-availability on a large sample or because of deficiency (grossly skewed, restricted range of values, etc.), except for the Missile Combat Crew Member (MCCM) Evaluation indices. The MCCM evaluation indices were considered acceptable as a criterion of success since they were quantitative (range 0.0-5.0), were conducted on a periodic basis throughout the year, and were obtained by a standardized procedure derived by personnel trained in performing MCCM evaluations.

3. DATA COLLECTION. Data were collected from records at Headquarters USAF, Headquarters SAC, and Chanute AFB, Illinois. The data were combined and stored on magnetic tape for analysis (see Appendix A for data items). The data collected were on an initial random sample of 399 individuals (n=399) out of a population of approximately 2011. The data gathered consisted of biographical and performance data.

4. ANALYSIS. Analysis involved the use of a multiple regression technique (BMDC2R Stepwise Regression). This technique incorporated the use of dummy variables as a means of establishing the relationship of qualitative variables to the criterion (MCCM evaluation indices), in addition to the typical regression procedure used for quantitative predictor variables. In the initial regression analysis 38 variables were correlated with the criterion (see Appendix B). The sample size, as previously mentioned, was 399. The only variable which yielded a correlation of any practical significance was "OER Mean" (r=.375).

A later regression analysis added a new variable for consideration (Air Training Command Standard Score). The data for this new variable was obtained from Chanute AFB, Illinois, where individual Minuteman Missile operator training was being conducted at the time of this study.[1] Records on individuals who received training were readily accessible only on those individuals who had completed the school in the past two year period. This factor resulted in a reduction of our initial sample of 399 to 218. Subsequent regression analysis revealed two significant variables, OER mean and Air Training Command Standard Score (ATCSS), which correlated with our criterion at r=.36 and r=.31 respectively. In addition, the intercorrelation between the two predictor variables was reasonably low (.12). Combining the two predictor variables resulted in a multiple correlation of .49.

The regression analysis program provided a transgeneration feature. Transgeneration refers to any transformations of an input variable which results in the generation of a new variable. This feature was exercised by taking certain promising variables to the following powers: X^2, X^3, and X^4 (see Appendix C). Results indicated that "OER Mean" taken to the fourth power (OER^4) increased its correlation to r=.47, while the ATC Standard Score linear relationship was the best correlation (r=.31). When combined the two yielded a multiple correlation of .52, with an intercorrelation of .19.

In reviewing appendices A, B, and C, other interesting correlations can be noted, such as the negative correlation between increase in age and performance. Depending on the level of significance established by an individual, a few of these may be found to be statistically significant; however, they have little practical significance. Also caution should be taken when generalizing about the variables which have been placed in discrete categories (dummy variables). This categorization resulted in very low n's in some of the discrete categories (n<10).

In addition to isolating two predictor variables, the following questions posed by Headquarters USAF were answered: Do certain source

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[1] Individual Minuteman Missile operator training was subsequently transferred to Vandenberg AFB, Calif.

of commission groups (ROTC, OTS, USAFA, etc.) perform better as Missile Crew Members than do other groups? Is there a difference in performance as a Minuteman Missile Combat Crew Member between rated and non-rated inputs? Do individuals with certain academic backgrounds perform better as Minuteman Missile Combat Crew Members than do other individuals? Are there any other variables which are significant?

In order to answer these questions, the factors of academic background, marital status, rated non-rated status, source of commission, and geographic area were broken out into subgroups and analyzed (see appendices A, B, and C).

After examining the size of the n within each subgroup and the correlation, it was found that none of the subgroups differed significantly from the others.

This does not mean, however, that these nonsignificant variables are not important. In fact, certain of these variables may have an equally important managerial implication. For example, take the problem of assigning a rated vs. a non-rated officer to missile crew duty during a period of pilot/navigator shortage. Since there was no significant difference in performance found between these officers, management would be justified in establishing a predominantly non-rated missile crew force when the rated force is critically needed in their rated specialty. This does not imply, however, that the rated officer force should not have missile experience at all. In fact, our upper management of the future should have both the knowledge of missile operations as well as aircraft operations. The thesis here is only that during periods where there is a drastic shortage of rated officers in rated assignments, management could draw on those rated officers earmarked for missile crew duty without degrading the missile force's performance.

SECTION III

RECOMMENDATIONS

A request of Headquarters SAC (DPPRM) for additional data for analysis was placed during a December, 1969, briefing on the progress of the research program. Due to a manpower shortage, within Headquarters SAC (DPPRM), the data has not been collected as of this date and the project is at an impasse. Recommend that a future study dealing with this problem obtain the data previously requested, which was Air Force Officer Qualification Test (AFOQT) scores and Operational Readiness Test (ORT) scores. It is also recommended that other pre-service factors be investigated, such as college Grade Point Average (GPA), which could prove extremely valuable when selecting newly commissioned officers for missile duty.

At present, with only two significant predictors (R=.52), a selection procedure is not feasible. The reason that a selection procedure is not feasible is twofold. First, one of the predictors is not available on newly commissioned officers (OER Mean). Second, the remaining predictor (ATCSS) is available only after an individual has completed individual training. In future research, should additional significant predictors be found among the AFOQT scores, ORT scores, and/or pre-service factors, it is highly likely that the resulting multiple correlation would be increased to a level where a flexible selection plan would be possible. This plan would include provisions for initial selection based on pre-service data and possibly OER data, as well as establishing a criterion for student elimination during ATC missile training and SAC Operational Readiness Training (ORT). In order to establish the validity of the data items selected, a cross-validation would be indicated prior to implementing the selection plan. This selection plan, which provides initial selection plus a course elimination feature, would insure that only those officers who would be high-quality Minuteman Missile Combat Crew Members would be assigned to missile duty. The results: a high-quality Missile Combat Crew force selected by a cost effective selection program.

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APPENDIX A

CRITERION AND PREDICTOR VARIABLES IN FINAL REGRESSION

	VARIABLES	VARIABLE NUMBER
	Criterion (Mean value of all MCCM evaluation ratings)	1
	Minuteman Education Program*	2
	Regular Commission*	3
	Age	4
	Age < 30*	5
	Years service	6
	Military obligation*	7
	Declined Regular Commission*	8
	Passed over for promotion*	9
	U.S. Citizen-spouse	10
	Education level*	11
Academic Factor	Engineering*	12
Academic Factor	Military Science*	13
Academic Factor	Social Science*	14
Academic Factor	Physical Science*	15
Academic Factor	Other B.S./B.A. Majors*	16
	Days in SEA	17
	COMBAT Tours (NR)	18
	Professional Military Education* (PME)	19
	PME - METHOD*	20

APPENDIX A (cont)

	VARIABLES	VARIABLE NUMBER
	RACE*	21
Marital Factor	Married*	22
	Single*	23
	Previously Married*	24
Rated Factor	Pilot*	25
	Non-rated*	26
	Rated-other than pilot*	27
	Officer Efficiency Report-Mean	28
Source of Commission Factor	Military Academy Graduate*	29
	ROTC*	30
	OTS*	31
	Other-commission source*	32
Geographic Factor	Southeast*	33
	Northeast*	34
	Midwest*	35
	Southwest*	36
	Far West*	37
	Number of Dependents	38
	Grade	39
	ATC Standard Score	40
	Age Squared (AGE^2)	41
	OER MEAN-4th power (OER^4)	42

APPENDIX A (cont)

VARIABLES	VARIABLE NUMBER
Grade Squared (Grade^2)	43
Grade-3rd power (Grade^3)	44

*Variables placed in discrete categories.

APPENDIX B

INITIAL REGRESSION ANALYSIS[a]

STEP[b]	VARIABLE/NUMBER		r	Multiple[c] r	Multiple[c] r^2
1	OER Mean	28	.38	.38	.14
2	Minuteman Ed. Program	2	.09	.39	.15
3	Grade	39	-.04	.40	.16
4	Rated-other than pilot	27	.05	.41	.17
5	Engineering	12	.08	.42	.18
6	Passed over	9	-.08	.42	.18
7	N.E.	34	.02	.43	.18
8	Social Science	14	-.07	.43	.19
9	Ed. Level	11	-.10	.44	.19
10	Military Obligation	7	.05	.44	.20
11	Years Service	6	-.01	.45	.20
12	Age	4	-.07	.45	.20
13	PME	19	-.01	.45	.21
14	Married	22	-.05	.46	.21
15	Physical Science	15	.0007	.46	.21
16	Race	21	.08	.46	.21
17	Other-commission source	32	.08	.46	.21
18	Days in SEA	17	-.07	.46	.22
19	U.S. Citizen-spouse	10	.13	.47	.22
20	Single	23	-.05	.47	.22
21	Combat Tours(NR)	18	.06	.7	.22

APPENDIX B (cont)

STEP[b]	VARIABLE/NUMBER		r	Multiple[c] r	Multiple[c] r^2
22	PMF-Method	20	.01	.47	.22
23	Regular Commission	3	.03	.47	.22
24	Midwest	35	-.06	.47	.22
25	NR Dependents	38	-.01	.47	.22
26	Academy Graduate	29	-.003	.47	.22
27	ROTC	30	.01	.47	.22
28	Pilot	25	-.01	.47	.22
29	Declined Reg. Comm.	8	.02	.47	.22
30	Military Science	13	.07	.47	.22

[a]Only those variables which had a sufficient F-level to be included in the regression are listed. F-level for inclusion .010, for deletion .005.

[b]Variables added in a stepwise manner, at each step the variable added is the one which makes the greatest reduction in the error sum of squares.

[c]Carried to four places and rounded to two.

APPENDIX C

REGRESSION ANALYSIS WITH TRANSGENFRATED VARIABLES[a]

STEP[b]	VARIABLE/NUMBER		r	Multiple[c] r	Multiple[c] r^2
1	OER[4]	42	.47	.47	.22
2	ATCSS	40	.31	.52	.27
3	Grade	39	-.14	.54	.29
4	Social Science	14	-.16	.55	.30
5	Engineering	12	.09	.55	.30
6	Age < 30	5	.13	.55	.31
7	Age^2	41	.13	.55	.31
8	Age	4	-.13	.56	.31
9	OER Mean	28	.36	.56	.31

[a]Only those variables which had a sufficient F-level to be included in the regression are listed. F-level for inclusion .010, for deletion .005.

[b]Variables added in a stepwise manner, at each step the variable added is the one which makes the greatest reduction in the error sum of squares.

[c]Carried to four places and rounded to two.